

■ ■ ■ ■ ■ PROPOSED PLAN  
OPERABLE UNIT  
NO. 2  
(GROUNDWATER)  
FOR FORMER  
NEBRASKA  
ORDNANCE PLANT  
MEAD, NEBRASKA  
DACA41-92-C-0023

Prepared for  
Department of the Army  
U.S. Army Engineers District  
Kansas City District  
Corps of Engineers  
Kansas City, Missouri  
October 1995

**Woodward-Clyde** 

Woodward-Clyde Consultants  
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200-1e



October 13, 1995  
WCC Project 92KW030R

Commander  
U.S. Army Engineer District, Kansas City  
ATTN: CEMRK-EP-EC (Ms. Rosemary Gilbertson)  
700 Federal Building  
601 East 12th Street  
Kansas City, Missouri 64106-2896

Re: Transmittal of Final Proposed Plan  
For Operable Unit No. 2 (Groundwater)  
Former Nebraska Ordnance Plant, Mead, Nebraska  
Contract No. DACA41-92-C-0023

Dear Ms. Gilbertson:

We are hereby transmitting three copies of the subject document. Distribution of the remaining copies of this document have been made in accordance with the attached distribution list.

Please contact us should you have any questions.

Very truly yours,

Curt Elmore, Ph.D., P.E.  
OU2 Project Manager

Robert F. Skach, P.E.  
Mead Project Manager

Enclosure

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FOR OPERABLE UNIT NO. 2 (GROUNDWATER)  
FORMER NEBRASKA ORDNANCE PLANT  
MEAD, NEBRASKA  
CONTRACT NO. DACA41-92-C-0023**

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F I N A L

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Overland Park, Kansas 66211

Project Number 92KW030R

B07NE003702-12652

## Proposed Plan



# Former Nebraska Ordnance Plant Operable Unit No. 2

Mead  
Saunders County, Nebraska

United States Army Corps of Engineers  
Kansas City District

August 22, 1995

### PURPOSE OF PROPOSED PLAN

This Proposed Plan describes the **remedial**<sup>1</sup> alternatives considered for Operable Unit No. 2 (OU2)<sup>2</sup> of the former Nebraska Ordnance Plant (NOP) and identifies the preliminary preferred remedial alternative with the rationale for this preference. The Proposed Plan was developed by the United States Army Corps of Engineers (USACE) with support from the United States Environmental Protection Agency (EPA), and the Nebraska Department of Environmental Quality (NDEQ). USACE and EPA are issuing this Proposed Plan to fulfill, in part, public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** of 1980, as amended, and Section 300.430(f) of the **National Contingency Plan (NCP)**. The alternatives summarized here are described in the OU2 **Remedial Investigation (RI)** and **Feasibility Study (FS)** reports which should be consulted for a more detailed description of all the alternatives.

This Proposed Plan is for the second of three **operable units (OUs)** identified at the former NOP (Site). The first operable unit (OU1) dealt with the reduction of exposure to the top four feet of explosives-contaminated soil in selected areas. The soils are a principal threat posed by the Site. A Proposed Plan for OU1 was issued on May 19, 1994, and is available in the **Information Repository**.

OU2 addresses remediation of contaminated **groundwater**, another of the principal threats posed by the site. OU2 also addresses explosives-contaminated soil (exclusive of those

addressed by OU1) which may be a continuing source of groundwater contamination.

The third operable unit (OU3) addresses a former **landfill** located on-site and any other disposal areas not included in the first two operable units. OU3 is currently in the remedial investigation stage and documentation will be available in the Information Repository at a future date.

This Proposed Plan summarizes information which is detailed in the OU2 RI/FS Reports, the **Baseline Risk Assessment**, and other documents contained in the administrative record file for this Site. USACE, EPA, and NDEQ encourage the public to review these additional documents to gain a comprehensive understanding of the Site and the activities which have been conducted. This Proposed Plan is intended to inform the public of USACE's and EPA's preliminary preferred remedy and to solicit public comments pertaining to all of the remedial alternatives evaluated, as well as the preferred alternative.

The remedy described in this Proposed Plan is the preferred remedy for the Site. Changes to the preferred remedy or a change from the preferred remedy to another remedy may be made if public comments or additional data indicate that such a change will result in a more appropriate remedial action. USACE and EPA will not select a final remedy until they have reviewed and considered all of the comments received during the public comment period. USACE and EPA are soliciting public comment on all of the alternatives set forth in this Proposed Plan and evaluated in the FS

<sup>1</sup>All of the terms appearing in **bold print** are defined in the glossary on p. 26 through 29.

<sup>2</sup>A list of abbreviations and acronyms can be found after the glossary on p. 29.

detailed analysis. Opportunities for public involvement are explained in detail later in this Proposed Plan.

### **COMMUNITY ROLE IN SELECTION PROCESS**

The former NOP was included on the **National Priorities List (NPL)** in August, 1990. USACE, EPA and NDEQ rely on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each NPL site. Therefore, the OU2 RI/FS Reports, Proposed Plan, and supporting documentation have been made available to the public for a public comment period which begins on October 30, 1995 and concludes on November 29, 1995.

A public meeting will be held during the public comment period at the University of Nebraska Agricultural Research and Development Center's (ARDC's) Research and Education Building on November 8, 1995, beginning at 6:00 p.m., to present the conclusions of the OU2 RI/FS, to further explain the reasons for recommending the preferred remedial alternative, and to receive public comments.

Comments received at the public meeting, as well as written comments submitted to the USACE, EPA and NDEQ within the public comment period, will be included in the **Administrative Record** and summarized in the **Responsiveness Summary** section of the **Record of Decision (ROD)**, the document which formalizes the selection of the remedy.

All written comments should be sent to Ms. Rosemary Gilbertson, USACE's Project Manager, at the following address:

c/o CEMRK-EP-EC (Ms. Rosemary Gilbertson)  
U.S. Army Engineer District, Kansas City  
700 Federal Building  
601 East 12th Street  
Kansas City, MO 64106-2896

### **SITE BACKGROUND**

#### History

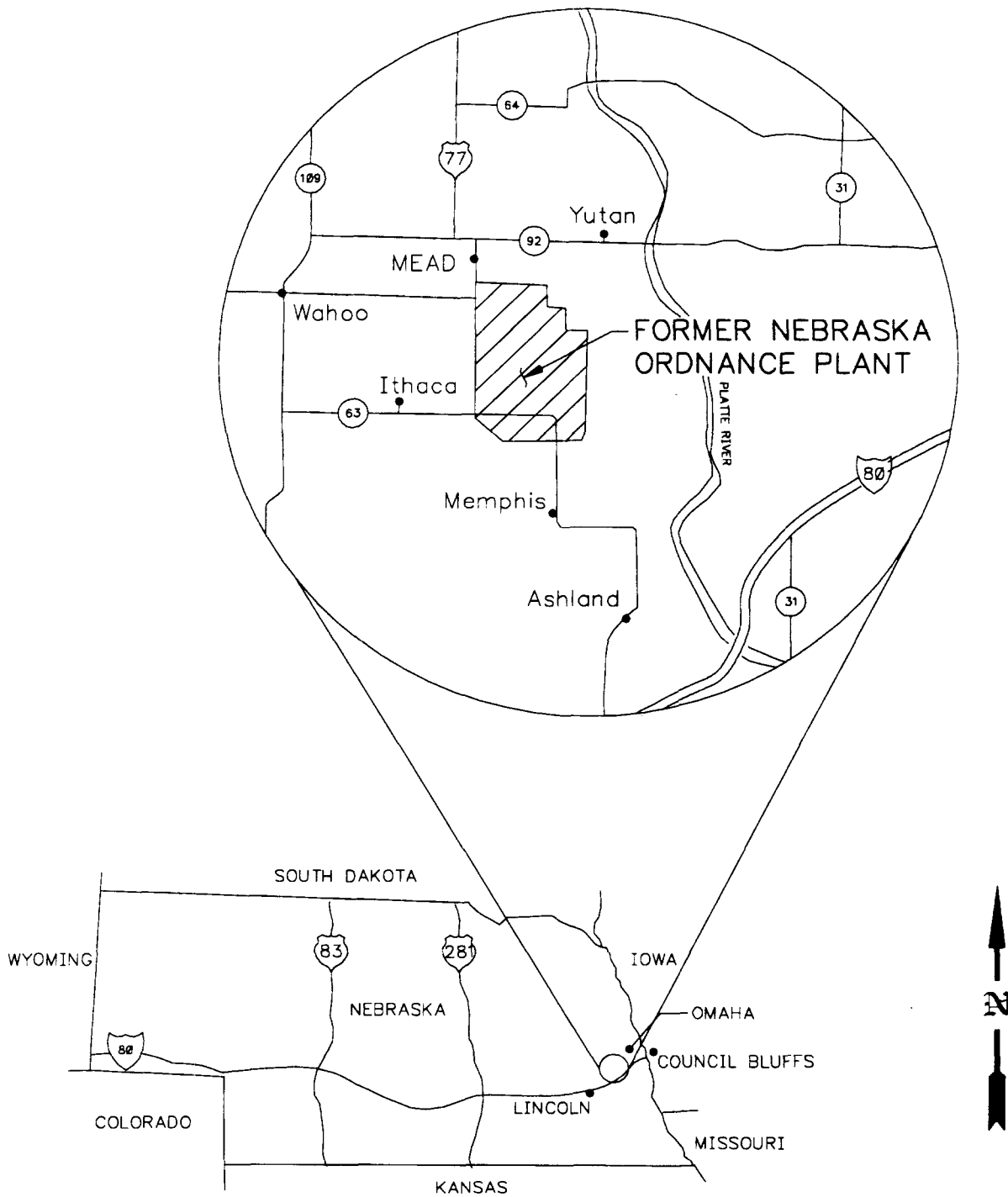
The former NOP (see Figure 1) was a facility at which bombs, boosters, and shells were assembled during World War II and the Korean Conflict. The raw materials used to manufacture the **ordnance** were produced at other locations and shipped to the NOP facility for assembly. Finished bombs, bulk explosives, and related ordnance materials and components were stored and deactivated at the NOP.

The Nebraska Defense Corporation operated the NOP from 1942 until 1945. Bombs and boosters were produced at the four load lines and the Bomb Booster Assembly Area (see Figure 2). Bombs were loaded with **2,4,6-trinitrotoluene (TNT)**, amatol (TNT and ammonium nitrate), tritonal (TNT and aluminum), and composition B [**hexahydro-1,3,5-trinitro-1,3,5-triazine (Royal Demolition Explosive or RDX** and TNT)]. **2,4- and 2,6-dinitrotoluene (DNT)** was also present as an impurity in the TNT. **Tetryl (n,2,4,6-tetranitro-n-methylaniline)** boosters for bombs were loaded in the Bomb Booster Assembly Area. During the NOP operations, explosives dust and residue were routinely washed out of the production facilities into local drainage features. The explosives-contaminated material infiltrated through the ground surface into the groundwater. In 1945, ordnance production operations were terminated and the former NOP was placed on inactive status after some of the buildings were decontaminated.

From 1945 to 1949, the NOP was used by the Army to store, rework and dispose of bulk explosives and munitions. During this period, ammonium nitrate was produced at the NOP for use as fertilizer.

In 1950, the plant was temporarily reactivated for the production of weapons used in the Korean Conflict. Munitions production included bombs, shells, rockets, warheads, block cast TNT, supplementary charges, and boosters. In 1956, the NOP was placed on standby status, and in 1959 was declared excess (property not needed) by the Army.

Figure 1  
General Site Location Map

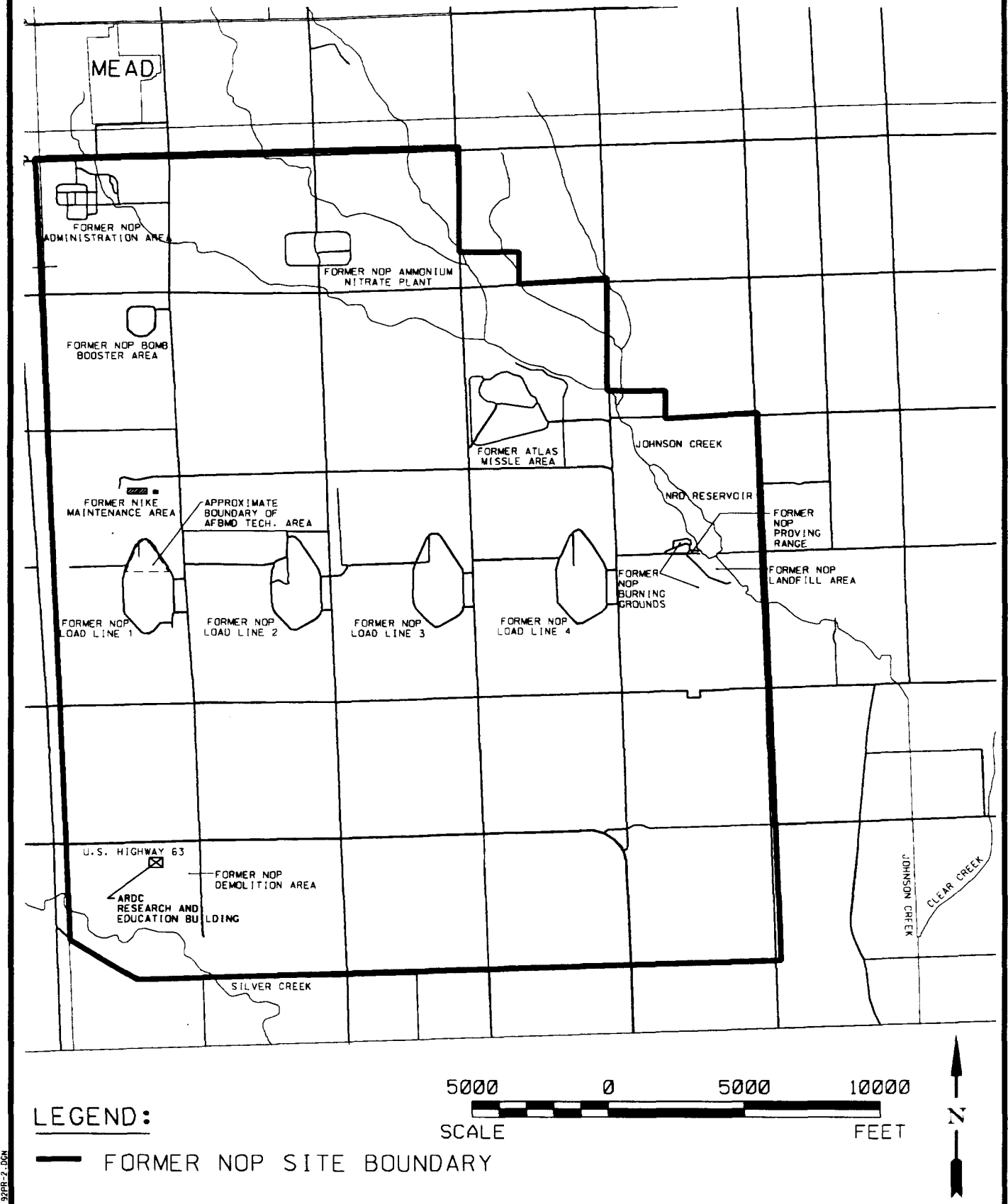


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# Figure 2 Site Map



After 1959, some portions of the property were retained by the Army and some portions were transferred to other **Department of Defense (DoD)** agencies, and the Department of Commerce. Approximately 10,200 acres were eventually purchased by private individuals, institutions and corporations.

In July 1959, the U.S. Air Force acquired land for the Offutt Air Force Base Missile Site (Atlas Missile Area) in the former ammonium nitrate storage area north of Load Line 4. Historical information suggests that **trichloroethene (TCE)** was released as ground spills and/or discharged into surface drainage features during the construction of the Atlas Missile facility during the period from 1959 to 1960. The exact locations, quantities, and dates of TCE disposal are not known. The Atlas Missile Area was transferred to the Nebraska National Guard in 1964.

The Air Force also acquired 34 acres north of Load Line 1 intended for use as an "Air Force Ballistic Missile Division (AFBMD) Tech Area." The purpose of the AFBMD Tech Area is unclear, but historical site information suggests that parts were cleaned with TCE in a laboratory at that location and the spent TCE was discharged into the sewer.

Currently, the former NOP property is primarily used for agricultural and livestock production and research. The research is conducted at the University of Nebraska ARDC.

As a former federal facility, the NOP is eligible for environmental restoration under the **Defense Environmental Restoration Program (DERP)**. USACE conducted site inventory and confirmation studies from 1989 to 1991 and found explosive compounds in the soil and groundwater. Based on the findings of these studies, the former NOP was included on the NPL on August 30, 1990.

#### Physical Characteristics

The Site is located in the Todd Valley, an abandoned **alluvial** valley of the ancestral Platte River. The thickness of unconsolidated material above bedrock in the Todd Valley at the Site ranges from approximately 81 feet to 157 feet. The unconsolidated material consists of topsoil, **loess**, sand, and

gravel. The uppermost bedrock unit is the Omadi Shale in the northwest and the Omadi Sandstone in the southeast portions of the Site.

Three **aquifers** are present at the Site: the Omadi Sandstone aquifer, the Todd Valley aquifer, and the Platte River alluvial aquifer. Three **aquitards** are present: the Pennsylvanian shales, the Omadi Shale, and the Platte River aquitards. Where the Omadi Shale is absent, the Omadi Sandstone and Todd Valley aquifers are in hydraulic communication with each other and behave as a single aquifer without hydraulic barriers.

The water-bearing portions of the unconsolidated material in the Todd Valley are divided into two units, an upper fine sand unit and a lower sand and gravel unit. During the OU2 RI, the sand and gravel unit was found to range from 17.5 to 72 feet thick and the fine sand unit was found to range from 12 to 77 feet thick. The upper fine sand unit is overlain by 4 to 23 feet of the Peoria Loess.

The sands and sandy gravels of the Platte River Valley, which range from 39 to 49 feet thick, were not deposited at the same time as the sands and gravels of Todd Valley. Overbank silts and clays ranging from 10 to 17 feet thick overlie the Platte River alluvial sands.

The water table surface of the Todd Valley slopes toward the south-southeast. A local zone of groundwater discharge is located along the western side of the Platte River floodplain in the southeastern portion of the Site. East of Johnson Creek, the water table surface of the Platte River alluvial aquifer slopes to the south, paralleling the Platte River Valley.

#### **REMEDIAL INVESTIGATION SUMMARY**

In 1992, USACE began the OU2 RI. The primary objective of the OU2 RI was to evaluate the extent and nature of **chemicals of concern (COCs)** in the groundwater at the Site attributable to past DoD activities. The secondary objective was to evaluate the potential nature and extent of **volatile organic compound (VOC)** contamination in soils at three areas (Administration Area, Atlas Missile Area, and the AFBMD Tech Area) to assess whether or not these contami-

nants are possible continuing sources of VOCs in the groundwater. Groundwater samples were collected from 136 **monitoring wells**, and the samples were analyzed for VOCs, explosive compounds, and general water quality parameters. Selected monitoring wells were also sampled for **semi-volatile organic compounds** and **metals**. Soil and **soil gas** samples were collected and analyzed for VOCs. Field data were also collected to characterize the geology at the Site, and to estimate the direction and rate of groundwater flow. Groundwater samples were collected from every monitoring well on a quarterly basis beginning during the OU2 RI (August 1992) and continuing for one year. Continued quarterly sampling of selected monitoring wells is ongoing.

The OU2 RI identified four areas of groundwater contamination or four groundwater contamination **plumes**. A separate source location has been identified for each plume. Two of the plumes consist of explosives contamination (primarily RDX) and two of the plumes consist of primarily TCE-contaminated groundwater. The plumes overlap in two areas and both TCE and RDX are in the groundwater at the same location.

More groundwater contamination was found in the upper fine sand units than in the sand and gravel units below. Generally, the least contamination was found in the deepest of the three aquifers, the Omadi Sandstone aquifer.

The OU2 RI data indicated that the Administration Area was not a continuing source of groundwater contamination. The Atlas Missile Area and the AFBMD Tech Area were identified as possible source areas of TCE contamination to groundwater. However, data did not conclusively indicate whether the Atlas Missile Area or the AFBMD Tech Area are, or are not, continuing sources of TCE to groundwater.

Results of previous OU1 investigations indicate that explosives contamination in soil is mostly limited to soils in and under drainage ditches and **sumps** in the load lines and the Bomb Booster Assembly Area. It is believed that this contamination originated from the discharge of water used to wash away explosives dust and residue which resulted from the ordnance load, assemble, and pack process. In the Burning/Proving Grounds, testing and burning activities probably

contributed to soil contamination. No significant explosives contamination was identified in the Administration Area. Please refer to the OU1 RI Report, which is in the Information Repository, for more details.

## **SUMMARY OF SITE RISK**

### Human Health Risk Assessment

The Baseline Risk Assessment was conducted to estimate risks associated with exposure to chemicals found in groundwater and subsurface soils. Potential risks were estimated for both current and possible future use scenarios, including site workers, construction workers, and child and adult residents. Exposure concentrations and parameters were selected to evaluate a **Reasonable Maximum Exposure (RME)**. EPA has defined the RME as the highest exposure that can reasonably be expected to occur at a site.

Two types of risk estimates were prepared as part of the Baseline Risk Assessment, potential excess **cancer risks** (i.e., risks above the normal expected cancer rate and non-cancer **Hazard Indices (HI)**). The cancer risks represent upperbound estimates of the probability that an individual might contract cancer as a result of exposure over a lifetime to a chemical. For example, a 3 in 10,000 (also expressed as  $3 \times 10^{-4}$ ) risk estimate means that not more than an additional 3 out of 10,000 people exposed would be expected to develop cancer. Non-cancer health hazards are addressed by comparing average (chronic) daily intakes to **reference doses**. A reference dose is the amount of a chemical that a person can take in over a long term without suffering adverse health effects.

When the calculated cancer risk from lifetime exposure to site-related chemicals is estimated to be more than one additional (excess) cancer case in 10,000 ( $1 \times 10^{-4}$ ), some kind of remedial action is generally required under the Superfund law. When the cancer risk is between one additional cancer case in 10,000 and one in 1,000,000 ( $1 \times 10^{-6}$ ) people, action may be necessary depending on such site-specific factors as location, environmental impact, and non-cancer health effects. If the risk is less than one additional cancer case in 1,000,000 people, action is generally not required unless

there are also environmental risks or non-cancer health effects. For non-cancer effects, an HI value of 1 is considered an upper "threshold" for possible adverse health effects. The following tables summarize the cancer risks and the non-cancer hazards associated with OU2 groundwater (and subsurface soil for the remediation construction worker) at the Site.

SUMMARY OF CANCER RISKS Acceptable cancer risk range is between one in ten thousand ( $1 \times 10^{-4}$ ) and one in one million ( $1 \times 10^{-6}$ )					
	Adult Resident	Child Resident	On-site Worker	Constr. Worker in Load Line 1	Constr. Worker in Atlas Missile Area
Monitoring Well MW-5B	$3 \times 10^{-4}$	$7 \times 10^{-5}$	$4 \times 10^{-5}$	$3 \times 10^{-8}$	$3 \times 10^{-8}$
Monitoring Well MW-40B	$2 \times 10^{-3}$	$6 \times 10^{-4}$	$2 \times 10^{-4}$	$4 \times 10^{-6}$	$4 \times 10^{-6}$

SUMMARY OF NON-CANCER HIs Acceptable HI range is less than 1					
	Adult Resident	Child Resident	On-site Worker	Constr. Worker in Load Line 1	Constr. Worker in Atlas Missile Area
Monitoring Well MW-5B	3	7	1	0.02	0.02
Monitoring Well MW-40B	3	13	0.9	1	1

The Baseline Risk Assessment identifies several chemicals as the principal sources of health risks. The two wells listed in the above tables were chosen for evaluation because they contained the highest concentrations of RDX (MW-5B) and TCE (MW-40B), the two COCs that contributed to the majority of Site risks. At well MW-5B, approximately 90 percent of the total cancer risk is due to RDX. Other explosives compounds (TNT and DNT) which were also found in MW-5B, contribute an additional 9 percent to cancer risk. Virtually all of the cancer risk due to chemicals detected at well MW-40B is attributable to TCE. Similar to the case of carcinogens, non-cancer hazards for MW-5B were driven by explosives and non-cancer hazards for MW-40B were driven by VOCs.

As discussed above, the two monitoring wells with the highest measured concentrations of TCE and RDX in ground-

water were used to develop the tables presented above. Cancer risks and HIs calculated in an identical manner for RDX and TCE concentrations measured in other monitoring wells would be lower than the tabulated values.

### Ecological Risk Assessment

An ecological risk assessment was performed as a part of OU1. Potential risks to the environment from contaminated soil at the Site are limited to areas where high levels of contaminants have been detected. Plants and small animals exposed to high contaminant levels may experience inhibited growth or other adverse effects. Due to the localized distribution of contaminated areas, however, exposure to contaminants is not likely to cause measurable effects on plant or animal populations. Likewise, concentrations of contaminants in on-site surface water are not likely to cause adverse effects to exposed organisms.

### **INTERIM ACTIONS**

#### Alternative Water Supply

Some of the domestic wells serving individual homes in the area have been contaminated by TCE, RDX, or both. Concentrations above the **Maximum Contaminant Level (MCL)** of 5 **micrograms per liter ( $\mu\text{g/L}$ )** for TCE and the **Health Advisory Level** of 2  $\mu\text{g/L}$  for RDX have been detected. In these residences, the USACE has installed and is maintaining point-of-entry **carbon adsorption** treatment systems to treat water before it is used for drinking, bathing, and other household activities. These systems will be maintained as long as the contaminant concentrations measured in the supply wells are above the MCL or Health Advisory.

In addition, some of the water supply wells for the ARDC have been contaminated. The USACE has installed and is maintaining carbon adsorption point-of-entry treatment systems for drinking water at each of the ARDC facilities.

### Containment Removal Action

Currently, a Containment **Removal Action** is being conducted at the Site. The specific objectives for the Removal Action are:

- Hydraulic containment of groundwater contamination to minimize expansion of the plumes prior to the initiation of the final remedy (the final remedy is the action that is the topic of this Proposed Plan). The Containment Removal Action is being conducted to stop the downgradient movement of the TCE plumes.
- Protection of unimpacted **downgradient** groundwater users
- Treatment and discharge of extracted groundwater to meet applicable standards
- Periodic monitoring of the effectiveness of the containment system

Because all of the proposed alternatives for the final remedy at the Site (except for the alternative which consists of only groundwater monitoring) include the element of hydraulic containment, the Containment Removal Action will be consistent with the final remedy.

The Containment Removal Action is being conducted by USACE with oversight by EPA and NDEQ, and the public was invited to participate during a public comment period held between June 26 and July 26, 1995.

### Soil Vapor Extraction Pilot Study

As discussed previously in the Remedial Investigation Summary Section, data did not conclusively indicate that the soils at the Atlas Missile Area and the AFBMD Tech Area are, or are not, continuing sources of TCE to groundwater. Therefore, remedial actions to address VOCs in soil vapor are not currently proposed and a pilot-scale soil **vapor extraction** (SVE) study is underway. The study has two purposes:

- To evaluate whether there is a recoverable source of TCE from the **vadose zone** at the Atlas Missile Area or the AFBMD Tech Area
- To evaluate the effectiveness of SVE in removing TCE from the vadose zone at the two locations

## **FEASIBILITY STUDY REPORT**

During the FS, the areas and volumes of contaminated groundwater were estimated, cleanup technologies were assessed, and remedial action alternatives were developed, evaluated, and compared in detail. As a part of the FS, treatability studies were initiated for granular activated carbon adsorption and **advanced oxidation** processes. These are technologies which may be potentially applied individually or in combination with each other and **air stripping** to treat extracted groundwater. The treatability studies will evaluate the effectiveness of the technologies and provide engineering information. The treatability study data will be used to select the type of groundwater treatment option prior to the design of the treatment plant. The treatment plant will be designed after the remedy has been selected.

Cleanup goals, remediation areas and volumes, a description of each alternative, and a summary of the alternatives evaluation and comparison are provided in the following sections. More detailed information can be found in the FS Report, which is located in the Information Repository. The results of the treatability studies will be contained in a Treatability Studies Technical Memorandum which will be forwarded to the Information Repository following the completion of the studies.

## **REMEDIAL ACTION OBJECTIVES**

Remedial action objectives are specific goals to protect human health and the environment; they specify the COCs, the exposure route(s), receptor(s), and acceptable chemical concentration(s) for each exposure route. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs) and additional health-based goals calculated from information presented in the FS Report.

The following remedial action objectives were established:

- Minimize the potential for **ingestion** of contaminated groundwater, or reduce concentrations to acceptable health-based levels

- Minimize the potential for **dermal** exposure to contaminated groundwater, or reduce concentrations to acceptable health-based levels
- Minimize the potential for **inhalation** of chemicals released during the use of contaminated groundwater, or reduce concentrations to acceptable health-based levels

The following chemicals were identified as COCs in the groundwater at the Site:

- Methylene Chloride
- 1,2-Dichloropropane
- TCE
- TNB
- TNT
- 2,4-DNT
- RDX

Three sets of Preliminary **Target Cleanup Goals** were developed in the FS Report for the COCs. Each target cleanup goal represents a different combination of protection of human health and the environment, and expenditure of public funds. The target cleanup goal components include concentrations specified by the EPA as MCLs or Lifetime Health Advisories, and concentrations calculated on the basis of health protectiveness. For non-cancer health protectiveness, the preliminary HI was specified as 1.0. For cancer health protectiveness, the preliminary range of excess cancer risks was between  $1 \times 10^{-6}$  and  $1 \times 10^{-4}$ , with  $1 \times 10^{-6}$  as the point of departure required by the NCP.

USACE, EPA, and NDEQ selected the following cleanup goals as the Final Target Groundwater Cleanup Goals for OU2. This selection was based on balancing protection of human health and the environment with conservation of public funds consistent with the need to meet regulatory requirements including MCLs.

FINAL TARGET GROUNDWATER CLEANUP GOALS	
Chemical of Concern	Concentration ( $\mu\text{g/L}$ )
Methylene Chloride	5
1,2-Dichloropropane	5
TCE	5
TNB	0.778
TNT	2
2,4-DNT	1.24
RDX	2

The rationale used to develop the Final Target Cleanup Goals for groundwater is described below.

- For those chemicals with MCLs established, the MCL is the cleanup goal
- For those chemicals that do not have MCLs, but have carcinogenic effects, non-carcinogenic effects, or Lifetime Health Advisories, the cleanup goal is the lowest of any of the following: the value from the carcinogenic risk of  $1 \times 10^{-5}$ ; the value calculated from the (non-carcinogenic) HI of 1.0; or the Health Advisories

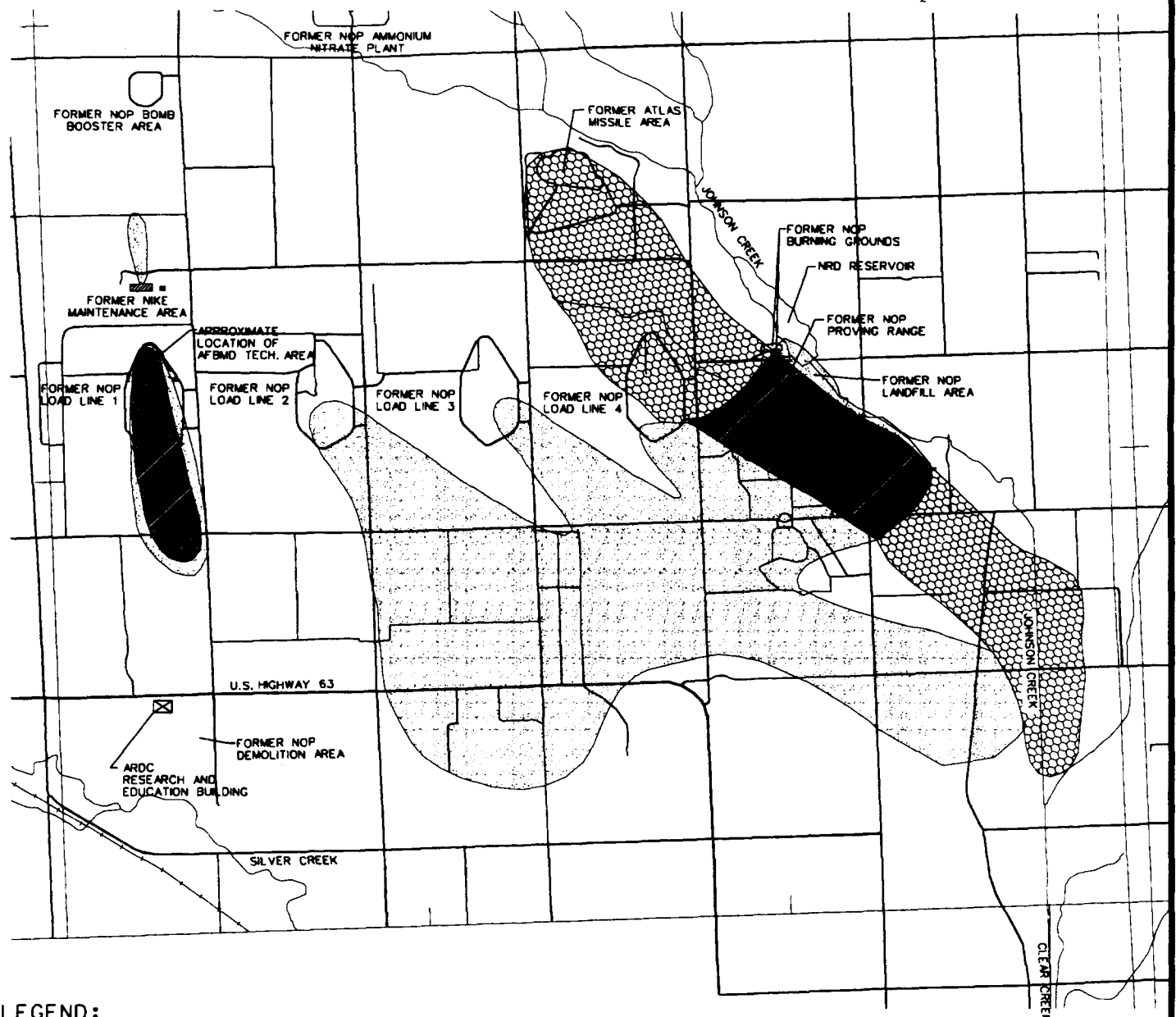
The volume of groundwater with COC concentrations exceeding the Final Target Groundwater Cleanup Goals is approximately 27 billion gallons (69,300 acre-feet) and underlies approximately 6,000 acres as shown on Figure 3. The FS Report contains a detailed discussion of the development of these areas and volume estimates.

#### **IMPACT OF SOIL CONTAMINATION ON GROUNDWATER REMEDIATION**




The OU1 soil remediation will remove all the soil to a maximum depth of 4 feet that pose a risk with respect to dermal contact or ingestion. Low concentrations of explosives will remain in soil outside and beneath the OU1 remediation areas. These soils could potentially act as a source of continuing contamination to groundwater and are subsequently referred to as "leaching soils" or "OU2 soils."

The remedial action objective for leaching soils is to remediate those soils to the degree that the groundwater remediation potentially benefits by saving time and money, or increasing protectiveness.

Figure 3  
Area of Groundwater with Concentrations  
Exceeding Final Target Groundwater Cleanup Goals



**LEGEND:**

-  APPROXIMATE AREA OF TCE-CONTAMINATED GROUNDWATER (CONCENTRATIONS GREATER THAN OR EQUAL TO MCL OF 5  $\mu\text{g/L}$ )
-  APPROXIMATE AREA OF EXPLOSIVES-CONTAMINATED GROUNDWATER (CONCENTRATIONS OF RDX GREATER THAN OR EQUAL TO THE HEALTH ADVISORY OF 2  $\mu\text{g/L}$ )
-  APPROXIMATE AREA OF COMBINED TCE AND EXPLOSIVES CONTAMINATION IN GROUNDWATER (TCE AND EXPLOSIVES CONCENTRATIONS GREATER THAN OR EQUAL TO 5  $\mu\text{g/L}$  AND 2  $\mu\text{g/L}$  RESPECTIVELY).



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The volume of leaching soils was defined as the volume of soils satisfying the following criteria:

- TNB soil concentrations greater than, or equal to, 5 mg/kg in the depth interval from the ground surface to 9 feet below ground surface
- TNB soil concentrations greater than, or equal to, 1 mg/kg in the depth interval from 9 feet to 12.5 feet below ground surface

The FS Report details the basis for the selection of the above criteria. The estimated time that any groundwater remediation system would be operational was compared to the estimated time that leaching soils could potentially act as a source of groundwater contamination. This comparison was used to evaluate the benefit of remediating the leaching soils.

If selected, any OU2 soil excavation and treatment are intended to occur concurrently with OU1 remedial activities to simplify excavation.

### **SUMMARY OF REMEDIAL ALTERNATIVES**

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost effective, comply with other statutory laws, and use permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, the act includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances. These requirements form the basis for the nine evaluation criteria applied to each remedial alternative. The nine criteria and the subsequent evaluation are discussed later in the Proposed Plan.

The FS Report provided detailed evaluation of the following eight remedial alternatives for addressing the groundwater contamination associated with the Site:

#### **ALTERNATIVE 1: NO ACTION**

- *Groundwater Monitoring*

#### **ALTERNATIVE 2: HYDRAULIC CONTAINMENT**

- *Hydraulic Containment of Groundwater*
- *Potable Water Supply*
- Groundwater Monitoring

#### **ALTERNATIVE 3: FOCUSED EXTRACTION**

- *Focused Extraction of Groundwater*
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

#### **ALTERNATIVE 4: FOCUSED EXTRACTION AND SOIL EXCAVATION**

- *Soil Excavation and Treatment*
- Focused Extraction of Groundwater
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

#### **ALTERNATIVE 5: FOCUSED EXTRACTION WITH AIR SPARGING**

- *Air Sparging*
- Focused Extraction of Groundwater
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

#### **ALTERNATIVE 6: FOCUSED EXTRACTION WITH AIR SPARGING AND SOIL EXCAVATION**

- Soil Excavation and Treatment
- Air Sparging
- Focused Extraction of Groundwater
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

#### **ALTERNATIVE 7: GROUNDWATER EXTRACTION**

- *Groundwater Extraction*
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

#### **ALTERNATIVE 8: GROUNDWATER EXTRACTION AND SOIL EXCAVATION**

- Soil Excavation and Treatment
- Groundwater Extraction
- Hydraulic Containment of Groundwater
- Potable Water Supply
- Groundwater Monitoring

Please note that a remedial technology is printed in italics the first time it appears in the list.



Except for the "No Action" alternative, all of the alternatives being considered include a number of common components associated with the extraction and treatment of groundwater. The common elements of Alternatives 2 through 8 include:

- Central treatment plant
- Applicable water treatment requirements
- **Beneficial reuse** or surface water discharge
- Potable water supply

The alternatives are:

#### **Alternative 1: No Action**

**Capital Cost:** None

**Operation and Maintenance Cost:** \$2 million per year

**Sum of Capital Cost and Present Worth Cost:** \$11 million

**Construction Time:** Not applicable.

**Restoration Time Frame Estimate:** 970 years

The **Superfund** program requires that the "no-action" alternative be considered as a baseline for comparison of other alternatives. Alternative 1 assumes groundwater monitoring of existing monitoring wells will be conducted quarterly for 5 years and annually thereafter, and no further action will be taken. Groundwater monitoring is also included as part of all of the subsequent alternatives.

#### **Alternative 2: Hydraulic Containment**

**Capital Cost:** \$8 million

**Operation and Maintenance Cost:** \$3 million per year

**Sum of Capital Cost and Present Worth Cost:** \$35 million

**Construction Time:** 1 year or less

**Restoration Time Frame Estimate:** 970 years

Alternative 2 consists of the hydraulic containment of the contaminated groundwater (as defined by the Final Target Cleanup Goals), potable water supply, plus the groundwater monitoring element of Alternative 1. The primary difference between Alternative 1 and Alternative 2 is that the Alternative 2 objective is to prevent the expansion of the area of contaminated groundwater. The hydraulic containment is accomplished at the Site by establishing a system of groundwater extraction wells along the downgradient edge of the

**area of attainment** and pumping the wells to prevent contamination from moving past the area of attainment. Currently, the leading edge of contamination in the Omadi Sandstone aquifer is within the area of attainment so the containment system will primarily extract water from the Todd Valley aquifer and the Platte River alluvial aquifer. Additional remedial action will be required if contaminants in the underlying Omadi Sandstone aquifer **migrate** to the downgradient edge of the area of attainment. The action might include increasing the flowrate in existing extraction wells or installing and operating new extraction wells. The extracted water is conveyed through a piping network to a treatment plant and treated to applicable water quality standards. Potential treatment technologies include granular activated carbon adsorption, advanced oxidation processes, and air stripping, any of which may be applied individually or in combination. The advanced oxidation treatment process is an emerging treatment method which means that advanced oxidation is an effective treatment method at small, experimental scales but has not been used as a full-scale groundwater treatment process. Granular activated carbon adsorption is a well-established technology for the removal of the previously listed COCs from groundwater. Air stripping has been demonstrated to be a successful treatment for groundwater containing VOCs. Subsequent to treatment, the water will be beneficially reused or discharged to a nearby creek. The selection of the treated groundwater disposal option, either surface water discharge or beneficial reuse, will be made during the remedial design analysis and will be based on the following criteria:

- Cost/benefit analysis
- Technical feasibility
- Public acceptance

The types of beneficial reuse which may be considered include reinjection into the aquifer, agricultural use (irrigation, livestock watering, processing, or other use), and water supply (including supply to a potential rural water district, the ARDC, Memphis, Mead, Ashland, Wahoo, Yutan, Lincoln or some combination of these potential water users). Detailed discussion of treated groundwater disposal options can be found in Section 4.2.1.5 of the FS Report.

An alternative domestic water supply would be provided for residents whose groundwater contained unacceptable concentrations of TCE or explosives as indicated by the Nebraska Department of Health (NDOH).

The objective of hydraulic containment is to prevent the further downgradient migration of contamination, rather than the clean up of the aquifer. Groundwater is pumped out during hydraulic containment. Some of that extracted groundwater will be contaminated. Therefore, the existing groundwater contaminant concentrations will eventually be lowered to the cleanup goals, although the concentration reduction will occur at a slow rate. For example, the clean up of the TCE plume with the suspected source at the AFBMD Tech Area and the overlapping explosives plume is estimated to take a few decades, the clean up of the explosives plume with the suspected source at Load Lines 2 and 3 is estimated to take nearly a century, and the clean up of the TCE plume with the suspected source at the Atlas Missile Area is estimated to take 970 years. The longest individual plume restoration time frame estimate (970 years) was selected as the overall Alternative 2 restoration time frame although major portions of the aquifer will be cleaned up much sooner. Similarly, the individual plume restoration time frames were estimated for Alternatives 3 through 8, and the longest estimate was selected as the overall restoration time frame estimate. This procedure provided an equivalent basis for the comparison of restoration time frames between alternatives.

The Alternative 2 restoration time frame estimate, 970 years, is so large that environmental conditions cannot be predicted for the end of the period with meaningful certainty. For practical purposes, Alternative 2 might be viewed as having endless duration, and the restoration time frame estimate could be perpetuity.

### **Alternative 3: Focused Extraction**

Capital Cost: \$13 million  
 Operation and Maintenance Cost: \$4 million per year  
 Sum of Capital Cost and Present Worth Cost: \$57 million  
 Construction Time: 1 year or less  
 Restoration Time Frame Estimate: Greater than 130 years

Alternative 3 includes all of the elements of Alternative 2 plus additional groundwater extraction wells which focus on areas with relatively high TCE and/or RDX concentrations.

The Alternative 3 individual plume restoration time frame estimates are as follows:

- AFBMD Tech Area TCE plume and overlapping explosives plume - greater than a few decades
- Load Lines 2 and 3 explosives plume - greater than several decades
- Atlas Missile Area TCE plume - greater than 130 years

Therefore, the restoration time frame estimate for Alternative 3 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goals is approximately 130 years. However, it is estimated that the leaching soils will continue contributing contamination to the groundwater in excess of the cleanup goals for an unknown time period longer than 130 years. Therefore, the estimated restoration time frame for Alternative 3 is an unknown time period which is greater than 130 years.

### **Alternative 4: Focused Extraction and Soil Excavation**

Capital Cost: \$17 million  
 Operation and Maintenance Cost: \$4 million per year  
 Sum of Capital Cost and Present Worth Cost: \$61 million  
 Construction Time: 1 year or less  
 Restoration Time Frame Estimate: Approximately 130 years

Alternative 4 includes the elements of Alternative 3 with the addition of excavation and incineration of leaching soils. Excavation limits for leaching soils were previously discussed in the section titled "Impact of Soil Contamination on Groundwater Remediation."

It is estimated that approximately 8,400 cubic yards of explosives-contaminated soil will be excavated and incinerated during the OU1 remediation. The approximate volume of additional explosives-contaminated soil to be excavated as a part of OU2 is 2,600 cubic yards, bringing the total volume of soil to be excavated and incinerated to 11,000 cubic yards. The entire 11,000 cubic yards of explosives-

contaminated soil would be excavated and incinerated together so that there will be cost and time savings realized by remediating the OU1 and OU2 soils together. The locations of the OU1 and OU2 soils are shown on Figures 4, 5, and 6.

The Alternative 4 individual plume restoration time frame estimates are as follows:

- AFBMD Tech Area TCE plume and overlapping explosives plume - a few decades
- Load Lines 2 and 3 explosives plume - several decades
- Atlas Missile Area TCE plume - 130 years

Therefore, the estimated time for Alternative 4 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goal is approximately 130 years. This is based on the estimate that, within 130 years, any explosives-contaminated soils remaining after the Alternative 4 soil remediation will no longer contaminate the groundwater in excess of the cleanup goals.

#### **Alternative 5: Focused Extraction with Air Sparging**

Capital Cost: \$32 million

Operation and Maintenance Cost: \$4 million per year

Sum of Capital Cost and Present Worth Cost: \$76 million

Construction Time: 1 year or less

Restoration Time Frame Estimate: Greater than 110 years

Alternative 5 includes the elements of Alternative 2 with the addition of groundwater extraction wells and in-situ **aeration** (called **air sparging**). The air sparging system will be located in the Atlas Missile Area where there are relatively high groundwater concentrations of TCE without the presence of explosives. Air sparging is an emerging technology which removes VOCs such as TCE from the groundwater without extracting the groundwater. This is accomplished by drilling wells in the aquifer to inject air into the contaminated groundwater. The air migrates upward through the groundwater, and the organic vapors are collected above the water table by a soil vapor extraction system and treated if necessary. This technology is not effective at removing explosives and is only proposed for areas of TCE-contaminated ground-

water. Therefore, the additional focused extraction wells will focus extraction on areas where the concentrations of both RDX and TCE are relatively high.

The Alternative 5 individual plume restoration time frame estimates are as follows:

- AFBMD Tech Area TCE plume and overlapping explosives plume - greater than a few decades
- Load Lines 2 and 3 explosives plume - greater than several decades
- Atlas Missile Area TCE plume - greater than 110 years

Therefore, the restoration time frame estimate for Alternative 5 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goals is approximately 110 years. However, it is estimated that the leaching soils will continue contributing contamination to the groundwater in excess of the cleanup goals for an unknown time period longer than 110 years. Therefore, the estimated restoration time frame for Alternative 5 is an unknown time period which is greater than 110 years.

#### **Alternative 6: Focused Extraction with Air Sparging and Soil Excavation**

Capital Cost: \$36 million

Operation and Maintenance Cost: \$4 million per year

Sum of Capital Cost and Present Worth Cost: \$81 million

Construction Time: 1 year or less

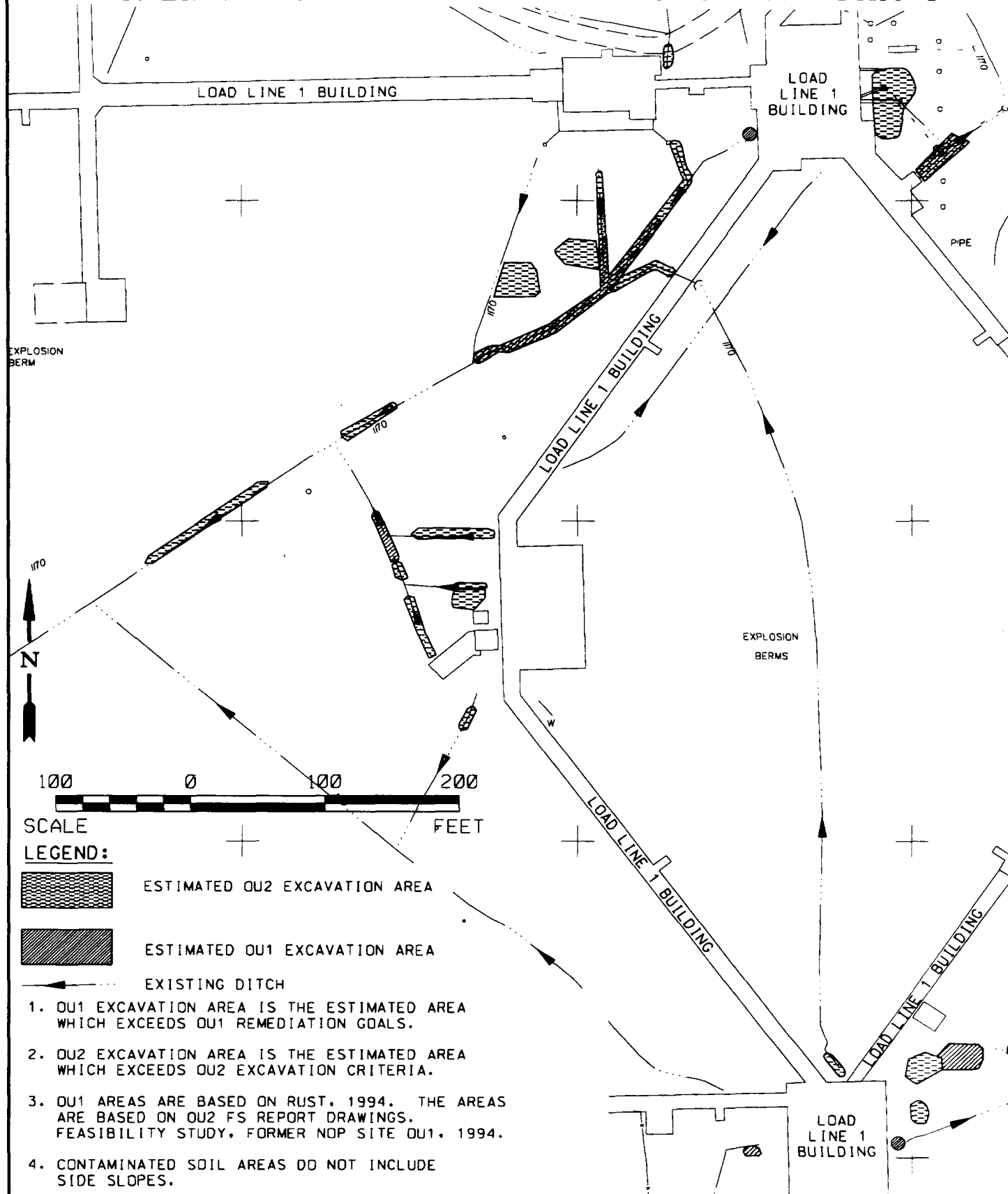
Restoration Time Frame Estimate: Approximately 110 years

Alternative 6 includes the elements of Alternative 5 with the addition of soil excavation and treatment described for Alternative 4.

The Alternative 6 individual plume restoration time frame estimates are as follows:

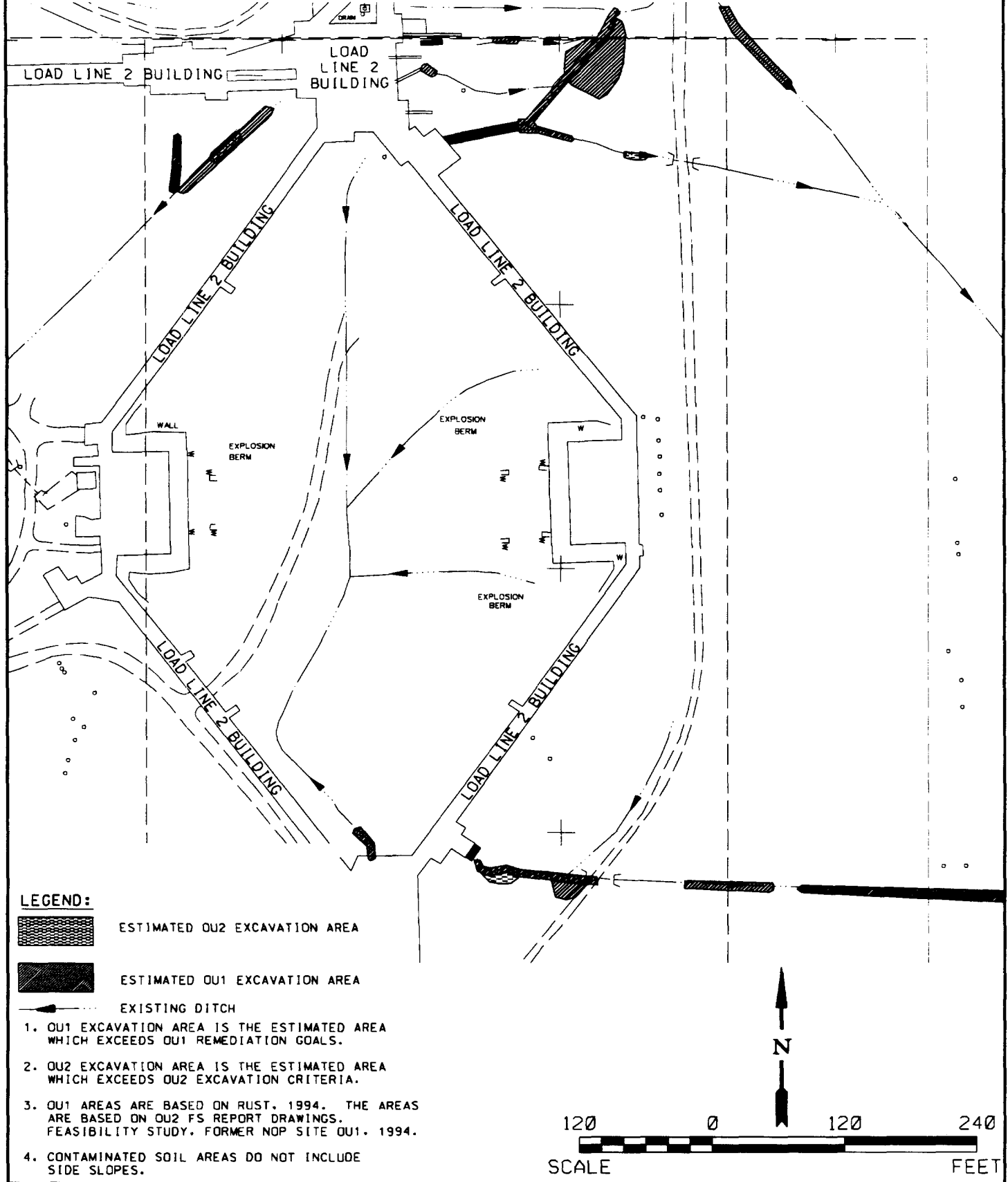
- AFBMD Tech Area TCE plume and overlapping explosives plume - a few decades
- Load Lines 2 and 3 explosives plume - several decades
- Atlas Missile Area TCE plume - 110 years

Figure 4  
Soil Excavation Areas - Former NOP Load Line 1



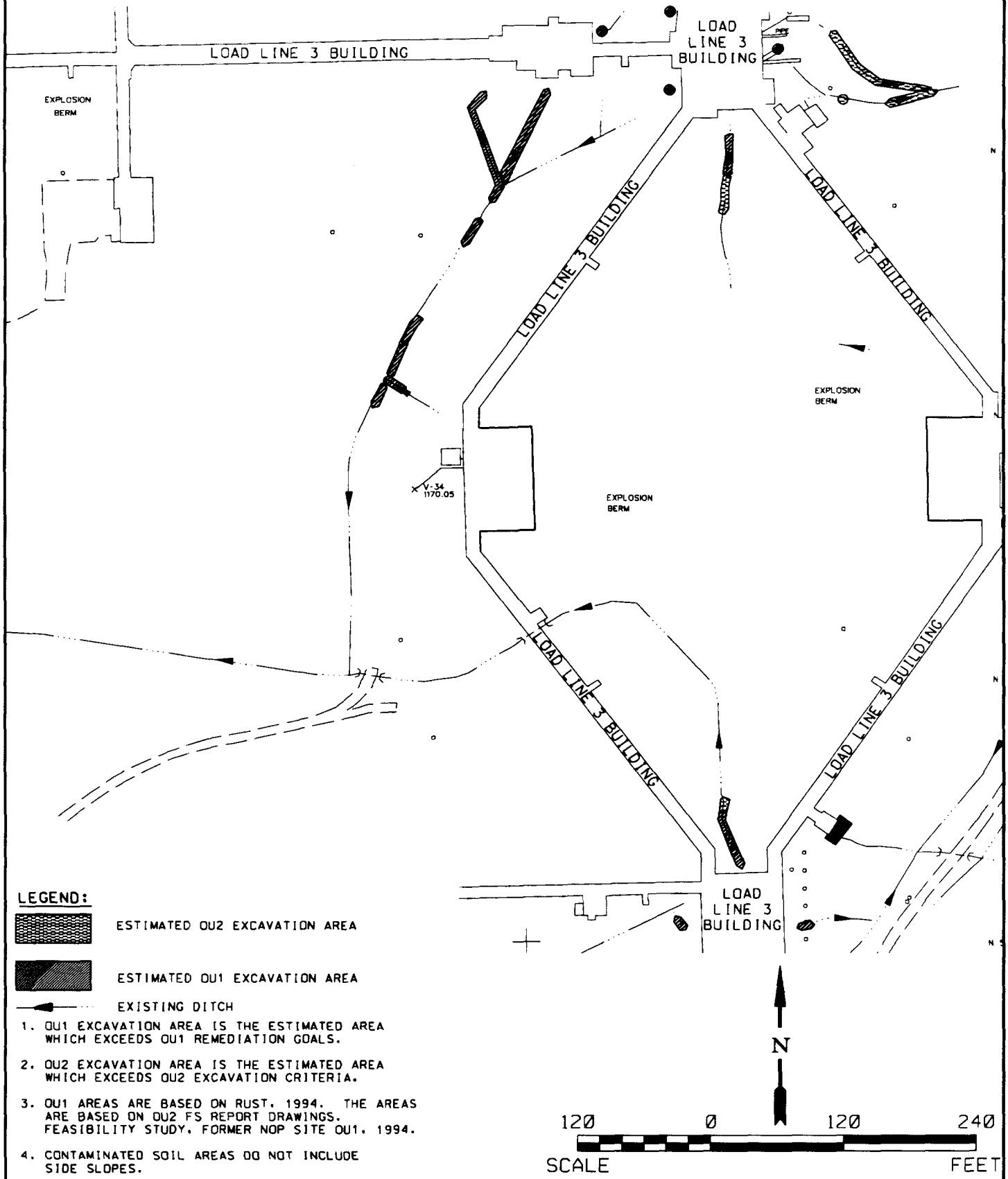
LL1PLN01.DGN

Figure 5  
Soil Excavation Areas - Former NOP Load Line 2



LL2PLN01.DGN

Figure 6  
Soil Excavation Areas - Former NOP Load Line 3



LL3PLN01.DGN

The estimated time for Alternative 6 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goal is approximately 110 years. This is based on the estimate that, within 110 years, any explosives-contaminated soil remaining after the Alternative 6 soil remediation will no longer contaminate the groundwater in excess of the cleanup goals.

#### **Alternative 7: Groundwater Extraction**

Capital Cost: \$15 million

Operation and Maintenance Cost: \$4 million per year

Sum of Capital Cost and Present Worth Cost: \$ 62 million

Construction Time: 1 year or less

Restoration Time Frame Estimate: Greater than 90 years

Alternative 7 includes the elements of Alternative 2 with additional groundwater extraction wells to extract contaminated groundwater throughout the contaminated areas.

The Alternative 7 individual plume restoration time frame estimates are as follows:

- AFBMD Tech Area TCE plume and overlapping explosives plume - greater than 31 years
- Load Lines 2 and 3 explosives plume - greater than 63 years
- Atlas Missile Area TCE plume - greater than 90 years

Therefore, the restoration time frame estimate for Alternative 7 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goals is approximately 90 years. However, it is estimated that leaching soils will continue contributing contamination to the groundwater in excess of the cleanup goals for an unknown time period longer than 90 years. Therefore, the estimated restoration time frame for Alternative 7 is an unknown time period which is greater than 90 years.

#### **Alternative 8: Groundwater Extraction and Soil Excavation**

Capital Cost: \$19 million

Operation and Maintenance Cost: \$4 million per year

Sum of Capital Cost and Present Worth Cost: \$66 million

Construction Time: 1 year or less

Restoration Time Frame Estimate: Approximately 90 years

Alternative 8 includes the elements of Alternative 7 with the addition of soil excavation and treatment described for Alternative 4.

The Alternative 8 individual plume restoration time frame estimates are as follows:

- AFBMD Tech Area TCE plume and overlapping explosives plume - 31 years
- Load Lines 2 and 3 explosives plume - 63 years
- Atlas Missile Area TCE plume - 90 years

Therefore, the estimated time for Alternative 8 to reduce the existing groundwater COC concentrations to the target groundwater cleanup goal is approximately 90 years. This is based on the estimate that any, within 90 years, explosives-contaminated soil remaining after the Alternative 8 soil remediation will no longer contaminate the groundwater in excess of the cleanup goals within 90 years.

### **EVALUATION OF ALTERNATIVES**

The preferred alternative for OU2 is Alternative 4, Focused Extraction and Soil Excavation. New information or public comments may cause USACE and EPA, in consultation with NDEQ, to modify the preferred alternative or select another remedy presented in this Proposed Plan and the FS Report. Based on current information, Alternative 4 provides the best balance among the nine criteria that EPA uses to evaluate remedial alternatives. This section describes these criteria and compares the eight remedial alternatives under consideration according to the criteria.

#### EPA's Nine Evaluation Criteria

During the detailed evaluation of remedial alternatives, each alternative is assessed against the nine evaluation criteria described below:

- o Overall protection of human health and the environment addresses whether or not a remedy provides adequate

protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- o Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements, or provide grounds for invoking a waiver.
- o Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up goals have been met.
- o Reduction of toxicity, mobility, or volume through treatment is the anticipated ability of the treatment to reduce the toxicity, mobility, or volume of the waste and, if possible, to what extent.
- o Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.
- o Implementability is the technical and administrative **feasibility** of a remedy, including the availability of materials and services needed to implement a particular option.
- o Cost includes estimated capital and operation, maintenance costs, and net present worth costs.
- o State acceptance is the evaluation of the technical and administrative issues and concerns the State may have regarding each of the alternatives.
- o Community acceptance will be assessed in the Record of Decision (ROD) following a review of the public comments received on the Proposed Plan.

#### Comparative Analysis of Alternatives

A comparative analysis of the alternatives based on the nine evaluation criteria follows:

- o Overall Protection of Human Health and the Environment

Alternative 1 does not provide an immediate reduction in human health risks for existing or potential future groundwater users. There is little if any environmental protection because Alternative 1 allows the migration of contaminated

groundwater to continue. Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option at this Site.

Alternatives 4, 6, and 8 provide the highest degree of overall protection of human health and the environment because the alternatives address contaminants in both groundwater and soil.

Alternatives 2 through 8 use point-of-entry systems and groundwater extraction to protect potential future groundwater users.

Alternatives 2 through 8 provide environmental protection by containing contaminated groundwater and minimizing its potential for migration past the area of attainment. These alternatives also reduce contaminant concentrations by groundwater treatment. The potential for contaminated soils to be a continuing source of groundwater contamination will be reduced by soil excavation and treatment in Alternatives 4, 6, and 8, providing additional protection of human health and the environment.

#### o Compliance with ARARs

CERCLA mandates that remedial actions be in compliance with other environmental and public health laws which are referred to as **ARARs**. In situations where groundwater remediation is undertaken, CERCLA also requires that standards set by the Safe Drinking Water Act, known as **MCLs**, be applied where appropriate to the contamination.

Alternatives 2 through 8 would comply with ARARs although Alternative 2 would require a very long time to do so. Laws and regulations pertinent to the Site are listed below. The FS Report contains a more detailed discussion of these regulations and how they will be addressed by each alternative.

#### **Federal**

Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 U.S.C. §6901 et seq.)

Safe Drinking Water Act (40 U.S.C. §300)



Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. §1251-1376)

Clean Air Act (CAA) (42 U.S.C. §§7401-7642)

Resource Conservation and Recovery Act of 1976 (RCRA), as amended. (42 U.S.C. §§6901-6987)

Hazardous Materials Transportation Act (Chapter 81 Article 15)

## State

Nebraska Environmental Protection Act (Revised Statutes of Nebraska, Chapter 81)

Water Quality Standards for Surface Waters of the State (Title 117, NDEQ)

Groundwater Quality Standards and Use Classification (Title 118, NDEQ)

Nebraska Drinking Water Standards (Nebraska Administrative Code, Title 179, Department of Health)

Nebraska Air Pollution Control Rules and Regulations (Title 129, Chapters 2, 3, 4, 5, 16, 17, 19, 10, 22, 39, NDEQ)

Rules and Regulations Pertaining to the Management of Wastes (Title 126, NDEQ)

Regulations Governing Licensure of Water Well and Pump Installation Contractors and Certification of Water Well Drilling and Pump Installation, and Water Well Monitoring Supervisors (Nebraska Administrative Code, Title 178, Nebraska Department of Health, Chapter 12)

Regulations Governing Water Well Construction, Pump Installation, and Water Well Abandonment Standards (Nebraska Administrative Code, Title 178, Nebraska Department of Health, Chapter 12)

National Pollutant Discharge Elimination Systems (NPDES) (Title 119, NDEQ)

Nebraska General NPDES Rules for New and Existing Sources (Title 121, NDEQ)

Rules and Regulations Governing Hazardous Waste Management in Nebraska (Title 128, NDEQ)

To be considered standards (TBCs) are non-promulgated advisories, criteria, or guidance issued by Federal or State government which are not legally binding. Lifetime Health

Advisories and Drinking Water Equivalent Levels (DWEL) are TBCs for the site.

## o Long-Term Effectiveness and Permanence

Alternatives 2 through 8 control long-term risk by point-of-entry groundwater treatment systems at impacted residences, and downgradient groundwater users are protected by the element of hydraulic containment. Long-term risk is further reduced in Alternatives 3 through 8 by groundwater extraction wells (in addition to the containment system). Soil treatment associated with Alternatives 4, 6, and 8 reduces the potential for long-term risk associated with the transfer of contaminants from the soil to the groundwater.

The point-of-entry treatment systems associated with Alternatives 2 through 8 are reliable and adequate to treat the COCs. Hydraulic containment and the other extraction systems which are a part of Alternatives 2 through 8 are reliable when the adequacy of the systems are monitored. Air sparging (Alternatives 5 and 6) is an emerging technology, and reliability and adequacy must also be monitored. Long-term engineering controls are not necessary for the soil treatment included as a part of Alternatives 4, 6, and 8.

Alternatives 2 through 8 will require periodic evaluations or reviews to ensure that the remedial action objectives are being met and human health and the environment are being protected. The effectiveness of the remedy will be periodically evaluated on a frequent basis beginning shortly after implementation. After the initial implementation period, the frequency of review will be reduced, however, reviews will continue to be conducted no less than once every five years until the remedial action objectives are achieved.

## o Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternatives 2 through 8 will eventually clean up all groundwater contamination, although the rate at which the groundwater is cleaned up will vary between alternatives. For example, it is estimated that Alternative 2 will essentially take forever to clean up the groundwater while Alternative 4 is estimated to take 130 years. Explosives contamination in

approximately 2,600 cubic yards of soil will be destroyed as a part of Alternatives 4, 6, and 8.

Alternatives 2 through 8 will reduce toxicity and volume of contaminated groundwater. The rate at which the volume of contaminated water is removed is proportional to the total extraction flowrate. The following list ranks the alternatives in terms of decreasing total extraction flowrate. The flowrates were used to estimate costs in the FS Report.

- Alternatives 7 and 8 (4,200 gallons per minute or GPM)
- Alternatives 3 and 4 (3,300 GPM)
- Alternatives 5 and 6 (2,770 GPM)
- Alternative 2 (2,100 GPM)

For Alternatives 2 through 8, the groundwater contaminants remain mobile but the mobility (potential for migration) is managed through containment. The incineration of explosives-contaminated soils, which is an element of Alternatives 4, 6, and 8; reduces toxicity, mobility, and volume of the explosive contaminants in the soils through treatment and reduces the potential threat of groundwater contamination.

The treatment technologies being considered for soil and/or groundwater as a part of Alternatives 2 through 8 destroy the contaminants and are therefore irreversible.

Residual materials resulting from the treatment of groundwater as a part of Alternatives 2 through 8 may include spent carbon from both groundwater and/or off-gas treatment. Residual materials from soil incineration (Alternatives 4, 6, and 8) may include scrubber water and/or ash. The quantities of all residual materials for Alternatives 2 through 8 are manageable and do not pose residual risk when properly managed.

Alternatives 2 through 8 satisfy the statutory preference for treatment.

#### o Short-Term Effectiveness

In terms of adverse environmental impacts, lowered water levels (**drawdown**) associated with the extraction of groundwater during Alternatives 2 through 8 may reduce the amount of groundwater available for aquifer users. The

potential for groundwater drawdown to adversely impact groundwater users is related to the extraction flowrates. Therefore, the highest potential for adverse environmental impacts is associated with Alternatives 7 and 8, and the lowest potential is associated with Alternative 2.

Risks to the community are not increased by the implementation of the groundwater remedies which are included as elements of Alternatives 2 through 8. For Alternatives 4, 6, and 8, there is potential for exposure due to dust during soil excavation and possible fugitive **emissions** during incineration. The potential for exposure during excavation can be managed using standard construction dust control practices such as the application of water or other dust suppressants. The incinerator which will be used at the Site to treat OU1 soils would also be used to treat OU2 soils. The OU1 incinerator will be a state-of-the-art unit. The potential for exposure during soils treatment can be managed by requiring the incinerator to operate at 99.99 percent destruction and removal efficiency (DRE), which is a measurement of the effectiveness of the combustion process in an incinerator. The 99.99 percent DRE requirement is applied to the principal contaminant, explosives compounds. Metals (which naturally occur in soil) associated with airborne particulates will be removed by the incinerator air pollution control system. All such risks are manageable.

There are relatively low risks to construction workers outside of general construction safety issues during the implementation of the groundwater remedies which are included as elements of Alternatives 2 through 8. For Alternatives 4, 6, and 8, there is potential for ingestion or inhalation of airborne material during excavation and transportation of contaminated soil. Such exposures can be controlled as discussed above.

There are relatively small adverse environmental impacts associated with the implementation of the groundwater remedies associated with Alternatives 2 through 8. Operation of the groundwater remediation systems will lower the water table to varying degrees at different locations. The potential aquifer drawdown at existing water supply wells (primarily domestic, irrigation, and stock wells) which may result from groundwater extraction could not be quantified during the FS because the extraction well locations will be

selected during the remedial design. The remedial design will try to minimize groundwater drawdown at existing water supply wells while balancing effectiveness and technical feasibility. The excavation and treatment of contaminated soils as a part of Alternatives 4, 6, and 8 will have a beneficial environmental impact because the potential for continuing contribution to groundwater contamination will be reduced.

The point-of-entry treatment systems associated with Alternatives 2 through 8 will be immediately available. Alternatives 2 through 8 are listed below in order of increasing restoration time frame estimates:

- Alternative 8 (90 years)
- Alternative 6 (110 years)
- Alternative 4 (130 years)
- Alternative 3 (greater than 130 years), Alternative 5 (greater than 110 years), and Alternative 7 (greater than 90 years)
- Alternative 2 (970 years)

Alternatives 3, 5, and 7 are listed in the same bullet because it is expected that the release of explosives from leaching soils to the groundwater will last approximately the same period of time for these alternatives which do not include leaching soil clean up. This time is not known, but it is expected to be a finite time greater than 130 years.

Please remember that the time frame estimates listed above are the longest individual plume restoration time frame calculated for each alternative. The restoration time frame estimates are shorter for the other plumes.

#### o Implementability

Carbon adsorption, air stripping, and advanced oxidation treatment technologies are being considered for the treatment of extracted groundwater as a part of Alternatives 2 through 8. Advanced oxidation is an emerging treatment technology as discussed in the description of Alternative 2. The air sparging element of Alternatives 5 and 6 is an emerging technology. Incineration of explosives-contaminated soil (Alternatives 4, 6, and 8) is a proven and effective treatment process.

Alternatives 2 through 8 possess the same degree of implementability with the exception of Alternatives 5 and 6 which rely on air sparging, an emerging technology. The emerging technology status means that the alternatives may be more difficult to implement.

The groundwater treatment system elements of Alternatives 2 through 8 can be constructed and operated using common practices. As discussed earlier, advanced oxidation treatment processes are emerging technologies. The air sparging element of Alternatives 5 and 6 may require specialized drilling procedures. The incineration of soils which is included as a part of Alternatives 4, 6, and 8 is a highly technical process but is commonly used and has demonstrated effectiveness.

Additional point-of-entry treatment systems and additional extraction wells can easily be added to Alternatives 2 through 8. The groundwater treatment system for those alternatives can be designed to allow for varying volumes and concentrations of groundwater. Additional capacity can be added with relative ease to the air sparging system which is an element of Alternatives 5 and 6. There is no need for expansion of the soil treatment system included as a part of Alternatives 4, 6, and 8.

Groundwater monitoring and the proposed treatment system would provide notice of potential failure of the groundwater extraction systems which are a part of Alternatives 2 through 8, and the air sparging system component of Alternatives 5 and 6. The soil treatment system of Alternatives 4, 6, and 8 will require emissions monitoring during implementation but no additional monitoring.

There is no anticipated difficulty in obtaining approvals and coordination with EPA and NDEQ for the groundwater treatment elements of Alternatives 2 through 8. Alternatives 4, 6, and 8 include soil incineration which will include a test of the treatment process called a trial burn prior to implementation of the OU1 remedy.

All services are available for the groundwater treatment elements of Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging

technology. All services are available for the soil treatment element of Alternatives 4, 6, and 8.

All materials, equipment, and specialists are available for Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging technology.

All technologies are available for Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging technology.

o Cost

The alternatives are listed below in order of increasing estimated capital costs:

- Alternative 2 (\$8 million)
- Alternative 3 (\$13 million)
- Alternative 7 (\$15 million)
- Alternative 4 (\$17 million)
- Alternative 8 (\$19 million)
- Alternative 5 (\$32 million)
- Alternative 6 (\$36 million)

The annual operation and maintenance costs are estimated to be approximately \$3 million for Alternative 2. The annual operation and maintenance costs for Alternatives 3 through 8 are estimated to be approximately \$4 million.

The alternatives are listed in order of increasing sum of capital cost and present worth costs of the operation and maintenance costs:

- Alternative 2 (\$35 million)
- Alternative 3 (\$57 million)
- Alternative 4 (\$61 million)
- Alternative 7 (\$62 million)
- Alternative 8 (\$66 million)
- Alternative 5 (\$76 million)
- Alternative 6 (\$81 million)

o State Acceptance

The preferred alternative is the subject of consensus among the parties of the **Interagency Agreement** (USACE, EPA, and NDEQ). This criterion includes the evaluation of technical and administrative issues and concerns NDEQ may have regarding each of the alternatives. This criterion will be

readdressed in the Record of Decision after public comments on the FS Report and the Proposed Plan have been received.

o Community Acceptance

Community acceptance of the preferred alternative will be assessed in the ROD following review of the public comments received on the RI/FS Report and the Proposed Plan.

### **PREFERRED ALTERNATIVE**

Based on an evaluation of the various alternatives, USACE, EPA, and NDEQ have preliminarily identified Alternative 4 as the preliminary choice for the Site remedy. Alternative 4 consists of the following elements: groundwater monitoring, potable water supply, hydraulic containment, focused extraction, and soil excavation and treatment.

The preferred alternative will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria. USACE, EPA and NDEQ believe that the preferred alternative will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will use permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy also will meet the statutory preference for the use of treatment as a principal element.

#### **Alternative 4:**

- Provides a high degree of overall protection of human health and the environment because it addresses contaminants in both groundwater and soil
- Most effectively maintains reliable protection of human health and the environment by removing soil contamination (in addition to the soil removed during OU1)
- Reduces the potential for long-term risk associated with the transfer of contaminants from the soil to the groundwater

However, compared to Alternatives 6 and 8, Alternative 4 will leave more water in the aquifer for local users. Alternative 4 (along with Alternative 3) provides the second highest rate of reduction of contaminated groundwater volume. However, the potential aquifer drawdowns

associated with Alternatives 3 and 4 are less than the drawdowns associated with Alternatives 7 and 8 (which have the highest rate of reduction of contaminated groundwater volume). Alternative 4 is estimated to require the third shortest time to remediate the groundwater. Although Alternatives 6 and 8 have shorter estimated restoration time frames, Alternative 4 is estimated to cost less.

Alternative 4 will be designed to comply with chemical-specific, location-specific, and action-specific ARARs, and other criteria and guidance such as TBC standards.

## **COMMUNITY PARTICIPATION**

### Public Meeting to Hear Community Concerns

CERCLA requires USACE and EPA to consider the views and comments of the public before making a decision on the remedial action. Public comments may cause USACE and EPA to modify the Proposed Plan or select another approach.

The public includes residents and organizations on the Site and in nearby communities, state agencies, and other interested parties and groups. Holding a public meeting is one way for interested parties to share their views and comments about the Proposed Plan.

Residents from throughout Saunders County and surrounding counties are encouraged to attend a public meeting scheduled at the ARDC Research and Education Building shown on Figure 2. USACE, EPA and NDEQ representatives will present information about the Proposed Plan and respond to questions. A court reporter will be present to record the meeting.

An interested party may also submit comments in writing, either by letter or by using the attached blank pre-addressed comment form included at the end of this Proposed Plan. Written comments should be sent to USACE, in care of Ms. Rosemary Gilbertson at the address noted at the beginning of this document.

## **PUBLIC COMMENT PERIOD AND PUBLIC MEETING**

### Public Comment Period

A public comment period, which extends from October 30, 1995 to November 29, 1995, has been established. The purpose of the comment period is to offer members of the public an opportunity to give USACE, EPA and NDEQ their views on the Proposed Plan and the other cleanup plans evaluated in the FS. A final decision on a remedial action will not be made until all of the comments received during the comment period have been evaluated. Comments must be postmarked no later than November 29, 1995.

Based on public comments or new information, USACE and EPA may decide to modify the preferred alternative or to select another remedial alternative from the FS rather than the plan which has been proposed. Therefore, it is important to comment on the Proposed Plan and any of the other alternatives proposed for controlling or cleaning up contamination related to OU2. USACE will respond to all comments it receives in a document called the Responsiveness Summary, which will be part of the Record of Decision and will be placed in the Information Repository at the Ashland Public Library. The Responsiveness Summary will be available to the public for review when the decision on the selected remedy is made and set forth in the Record of Decision.

### Public Meeting

A public meeting will be held on November 8, 1995. USACE, EPA, and NDEQ officials will discuss the Proposed Plan and answer questions. At the meeting, the public also will be able to present spoken and written comments on the Proposed Plan.

Date: November 8, 1995

For more information: Ms. Rosemary Gilbertson  
(816) 426-2604, Ext. 3077

The OU2 Information Repository has been established at the following location:

Ashland Public Library  
207 North 15th Street  
Ashland, Nebraska 68003  
(402) 944-7430

The Information Repository contains the OU2 RI and FS Reports, Baseline Risk Assessment, and other material relied upon in reaching a decision on the selection of the Proposed Plan. The Ashland Public Library also has been established as the Information Repository for OU1 and OU3 documents. The Ashland Public Library is open according to the following schedule which may be subject to change:

Mondays: 1:00 pm - 6:00 pm  
Tuesdays: 1:00 pm - 5:00 pm, 7:00 pm - 9:00 pm  
Thursdays: 9:00 am - 12:00 pm, 2:00 pm - 5:00 pm, 7:00 pm - 9:00 pm  
Saturdays: 9:00 am - 12:00 pm, 1:00 pm - 5:00 pm

If you have any questions about USACE's Proposed Plan or the public comment period, please contact the following USACE, EPA, and NDEQ personnel:

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## GLOSSARY

### Of Terms Used In the Proposed Plan

This glossary defines the technical terms used in this Proposed Plan. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management, and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

**Advanced Oxidation:** A treatment process which uses oxidizing agents such as ozone and hydrogen peroxide to destroy organic contaminants.

**Administrative Record:** The body of documents that forms the basis for the selection of a particular response at a site.

**Aeration:** A process that promotes breakdown of contaminants in soil or water by exposing them to air.

**Air Sparging:** A treatment system that removes or "sparges" volatile organic compounds from contaminated groundwater by forcing an airstream through the water in the aquifer and causing the compounds to evaporate. The emissions are collected and treated if necessary.

**Air Stripping:** A process whereby volatile organic compounds are removed from contaminated material by forcing a stream of air through it in a vessel. The contaminants are evaporated into the air stream. The air may be further treated before it is released into the atmosphere.

**Alternative Water Supply:** Replacement of contaminated water supply with a potable water supply.

**Alluvial:** An adjective describing sand, clay, or other similar material that was gradually deposited by moving water, such as along a river bed.

**Applicable or relevant and appropriate requirements (ARARs):** Federal and state environmental laws and regulations.

**Aquifer:** The geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs. The water contained in the aquifer is called groundwater.

**Aquitard:** An underground layer of typically fine-grain materials such as silt or clay that retards or restricts the flow of groundwater.

**Area of Attainment:** The area of contamination which is the focus of the remedial action. For this operable unit, the area of attainment is defined by the outermost edge of groundwater contamination (corresponding to the Final Target Groundwater Cleanup Goals) in groundwater at any depth. See Figure 3.

**Baseline Risk Assessment:** A study of the actual or potential danger to human health and welfare from hazardous substances at a specific site. The Baseline Risk Assessment estimates risks at the Site as it exists today, with no remedial action taken.

**Beneficial Reuse:** Using treated groundwater in some advantageous manner which might include, but is not limited to: reinjection into the aquifer, or providing the water to a user such as the ARDC, a municipality or a rural water district.

**Cancer Risk:** Incremental probability of an individual developing cancer as a result of potential carcinogen exposure averaged over a lifetime.

**Capital Cost:** Direct cost of project installation which includes the construction costs.

**Carbon adsorption:** A treatment system in which contaminants are removed from groundwater and surface water by forcing water through tanks containing activated carbon, a specially treated material that attracts and holds or retains (absorbs) contaminants.

**Chemicals of Concern (COCs):** A subset of all the chemicals detected on-site representing those contaminants posing the

greatest potential health risks at the Site due to their inherent toxicity and/or prevalence at the Site.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA):**

The Comprehensive Environmental Response, Compensation, and Liability Act, also referred to as "Superfund." The Superfund Amendments and Reauthorization Act (SARA) was passed by Congress in 1986 to update and improve CERCLA. CERCLA authorizes the federal government to respond directly to releases, or threatened releases, of hazardous substances that may endanger public health, welfare, or the environment. CERCLA established a \$1.6 billion Hazardous Waste Trust Fund made up of taxes on crude oil and commercial chemicals. When CERCLA was reauthorized by Congress in 1986, the fund was increased to \$8.5 billion. An additional \$5.1 billion was added in 1990 for the period 1990 through 1994. EPA is responsible for managing the CERCLA program.

**Defense Environmental Restoration Program (DERP):** A program established to design and implement cleanups at sites historically used by the United States government for military activities.

**Dermal:** To come into contact with a contaminant by means of direct skin contact with contaminated soils or groundwater.

**DNT (2,4- and 2,6-dinitrofluorene):** An organic compound which is present in bombs and other ordnance because it is an impurity in TNT.

**Downgradient:** The direction towards which groundwater flows.

**Drawdown:** The lowering of the aquifer water table by pumping groundwater.

**Emissions:** In this document, emissions refer to air-borne material generated during treatment of soil or groundwater.

**Feasibility:** Ability to be done.

**Feasibility Study (FS):** A comprehensive evaluation of potential alternatives for remediating contamination. The Feasibility Study (FS) identifies general response actions, screens potentially applicable technologies and process options, assembles alternatives, and evaluates alternatives in detail.

**Groundwater:** Water found beneath the ground's surface that fills pores between materials such as sand, silt, gravel, or rock.

**Hazard Indices (HI):** A numerical representation of the toxic hazard, unrelated to cancer, posed by a site. An HI value less than 1 indicates the lack of any non-cancer hazard, while a value greater than 1 indicates the potential for a health concern.

**Health Advisory:** Health advisory values are health-protective chemical concentrations in groundwater based on non-carcinogenic effects. Health advisories are derived by EPA.

**HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)**

High Melt Explosive: An explosive organic chemical used in the manufacture of bombs, other ordnance, and also present as an impurity in RDX.

**Information Repository:** The location where project documents are available for public review. The Ashland Public Library is the Information Repository for the former NOP Site.

**Ingestion:** To come into contact with a contaminant by means of eating or drinking contaminated soils or groundwater.

**Inhalation:** To breathe in.

**Interagency Agreement:** A written agreement between EPA and another federal agency carrying out site cleanup activities (e.g., the Department of Defense), that sets forth the roles and responsibilities of the agencies for performing and overseeing the activities. States are often parties to interagency agreements.

**Landfill:** A disposal facility where waste is placed in or on land.



**Loess:** Silt which has been transported and deposited by wind.

**Maximum Contaminant Level (MCL):** The maximum permissible concentration of a chemical in water which is delivered to any user of a public water system. MCL's are established by the EPA under the Safe Drinking Water Act and are to be attained when they are relevant and appropriate to the circumstances of a release at a CERCLA site.

**Metals:** Chemical elements such as iron and aluminum generally characterized by ductility, malleability, luster and conductivity of heat and electricity. These chemicals exist in dissolved form in groundwater.

**Micrograms per liter ( $\mu\text{g/L}$ ):** Units of concentration corresponding to the mass of solute per unit volume of solution. When the units are used with aqueous concentrations, they refer to the mass of chemical in one liter of water, which corresponds to 1 part per billion. When used for soil gas, they refer to the mass of chemical in one liter of gas.

**Migrate:** Movement of contaminants, water, or other liquids through porous and permeable rock.

**Monitoring Well:** A groundwater well installed in an aquifer for monitoring the water table elevations, collection of groundwater samples for detection of contaminants and for monitoring movement of contaminants present in the aquifer.

**National Contingency Plan (NCP):** Federal regulations specifying the methods and criteria for cleaning up Superfund sites.

**National Priorities List (NPL):** EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response.

**Operable Unit (OU):** A term which refers to a portion of a Superfund site where action is undertaken in incremental steps to remedy risks to human health or the environment.

Operable units are identified to address problems in separate phases or at separate portions of a site.

**Ordnance:** Military supplies, including weapons, ammunition, combat vehicles, maintenance tools, and equipment. The ordnance assembled at this site were explosive devices such as bombs.

**Perpetuity:** Endless duration.

**Plume:** A body of groundwater with contaminant concentrations exceeding the Final Target Groundwater Cleanup Goals.

**Present Worth Cost:** The money which must be invested today at a given interest rate to have money necessary to pay for the future cost of annual operation and maintenance. The present worth costs presented in this document were calculated using an 80-year project life and a 6 percent discount rate.

**RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)** Royal Demolition Explosive: An organic compound used in the manufacture of bombs and other ordnance.

**Reasonable Maximum Exposure (RME):** The highest exposure that could reasonably be expected to occur at a site.

**Record of Decision (ROD)** An EPA legal document issued after a Remedial Investigation and Feasibility Study that sets forth the selected remedy for cleanup of a site.

**Reference Dose:** EPA's estimate of an exposure level that is likely to be without an appreciable risk of adverse non-cancer effects.

**Remedial:** An adjective describing the course of study combined with actions to correct site contamination problems through identifying the nature and extent of cleanup strategies under the Superfund program.

**Remedial Investigation (RI):** The first part of a two-part study which determines how much and what kind of contamination exists at a site. A Remedial Investigation generally

involves collecting and analyzing samples of groundwater, surface water, soil, sediment, and air. The second part of the study is a Feasibility Study (see above).

**Removal Action:** An interim cleanup action conducted prior to the implementation of the final remedy.

**Responsiveness Summary:** A portion of the Record of Decision in which public comments are summarized and responses to comments are made. The responsiveness summary addresses public comments on the Proposed Plan and other documents.

**Restoration Time Frame Estimate:** A general estimate of the time which will be required to reduce the contamination to the final acceptable exposure levels.

**Soil Gas:** Gas occurring in the unsaturated soil pore spaces.

**Semi-volatile Organic Compound:** Organic compounds which do not vaporize at room temperature.

**Sumps:** A pit or tank that catches liquid runoff for drainage or disposal.

**Superfund:** The common name given to CERCLA (see above).

**Target Cleanup Goals:** The concentrations which are the objective of the remedial action.

**Tetryl:** An organic chemical used in producing bomb boosters. Boosters were used to initiate explosion of a bomb or other piece of ordnance.

**TNT (2,4,6-trinitrotoluene):** An organic chemical used in the manufacture of bombs and other ordnance.

**Trichloroethene (TCE):** A stable, colorless liquid with a low boiling point. TCE has many industrial applications, including use as a solvent and as a metal degreasing agent. TCE may be toxic to humans when inhaled, ingested, or through skin contact and can damage vital organs, especially the liver [see also Volatile Organic Compounds].

**Vadose Zone:** The area between the ground surface and the top of the water table where the soil is not completely saturated with water.

**Vapor Extraction:** The process of applying a vacuum to extraction wells installed in the vadose zone to remove VOCs.

**Volatile Organic Compounds (VOCs):** A group of organic compounds that have a tendency to change from liquids to gases at relatively low temperatures.

## LIST OF ACRONYMS AND ABBREVIATIONS

<b>AFBMD</b>	- Air Force Ballistic Missile Division	<b>TNT</b>	- 2,4,6-trinitrotoluene
<b>ARARs</b>	- Applicable or Relevant and Appropriate Requirements	<b>USACE</b>	- United States Army Corps of Engineers
<b>ARDC</b>	- Agricultural Research and Development Center	<b>VOC</b>	- Volatile Organic Compound
<b>BRA</b>	- Baseline Risk Assessment	<b>g/L</b>	- micrograms per liter
<b>CAA</b>	- Clean Air Act		
<b>CERCLA</b>	- Comprehensive Environmental Response, Compensation, and Liability Act		
<b>COCs</b>	- Chemicals of Concern		
<b>DERP</b>	- Defense Environmental Restoration Program		
<b>DNT</b>	- 2,4- and 2,6-dinitrotoluene		
<b>DoD</b>	- Department of Defense		
<b>DRE</b>	- destruction and removal efficiency		
<b>DWEL</b>	- Drinking Water Equivalent Levels		
<b>EPA</b>	- Environmental Protection Agency		
<b>FS</b>	- Feasibility Study		
<b>HAs</b>	- Lifetime Health Advisories		
<b>HI</b>	- Hazard Indices		
<b>MCL</b>	- Maximum Contaminant Level		
<b>NCP</b>	- National Contingency Plan		
<b>NDEQ</b>	- Nebraska Department of Environmental Quality		
<b>NDOH</b>	- Nebraska Department of Health		
<b>NOP</b>	- Nebraska Ordnance Plant		
<b>NPDES</b>	- National Pollutant Discharge Elimination Systems		
<b>NPL</b>	- National Priorities List		
<b>OU1</b>	- Operable Unit No. 1		
<b>OU2</b>	- Operable Unit No. 2		
<b>OU3</b>	- Operable Unit No. 3		
<b>OUs</b>	- Operable Units		
<b>RCRA</b>	- Resource Conservation and Recovery Act		
<b>RDX</b>	- Royal Demolition Explosive		
<b>RI</b>	- Remedial Investigation		
<b>RME</b>	- Reasonable Maximum Exposure		
<b>ROD</b>	- Record of Decision		
<b>SARA</b>	- Superfund Amendments and Reauthorization Act		
<b>SVE</b>	- soil vapor extraction		
<b>TBCs</b>	- To Be Considered standards		
<b>TCE</b>	- trichloroethene		